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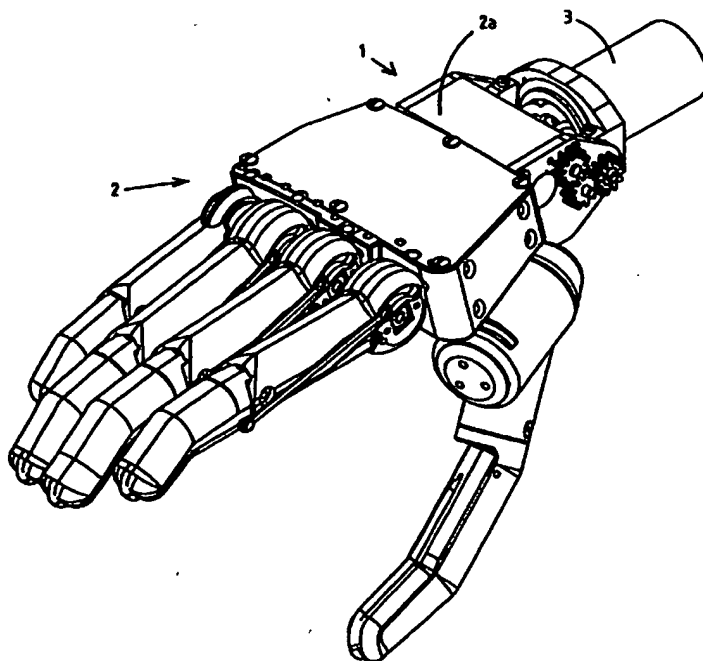
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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: **DEVICE AT A HAND PROSTHESIS**



(57) Abstract: Arrangement (1) for a hand prosthesis (2), which hand prosthesis (2) is adapted to replace a lost human hand on a human or artificial lower arm (3). The arrangement (1) is mounted between a wrist part (2a) and a lower arm (3). In addition the arrangement (1) has means for effecting tilting or turning of the hand part (2) relative to the lower arm (3).

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**TITLE**

DEVICE AT A HAND PROSTHESIS.

**DESCRIPTION****TECHNICAL FIELD**

- 5     The present invention relates to an arrangement for producing a movement for a prosthesis hand relative to a prosthesis arm or a human arm. The arrangement is intended to replace a lost hand joint or wrist.

**BACKGROUND OF THE INVENTION AND RELEVANT PROBLEM**

- 10    When a living hand or hand joint is lost or amputated it can be replaced by, respectively, a hand prosthesis or hand joint prosthesis. This means the loss of a satisfactorily operating body part having a realistic appearance, size, movement pattern and force assimilation capability.

- 15    The prosthesis that is to replace the lost body part should be simple to repair and should furthermore be inexpensive to produce.

- 20    One of the known hand prostheses comprises an unnaturally long wrist, which gives it an unrealistic appearance. The long length of the wrist prosthesis is due to the fact that in certain cases it includes a number of functions that a prosthesis hand has to perform, such as for example various movements of the parts of the prosthesis hand.

**25    OBJECT OF THE INVENTION AND SOLUTION OF THE PROBLEM**

The object of the present invention is to solve some or other of the aforementioned problems.

- 30    This object is achieved with an arrangement according to claim 1 and a method according to claim 9.

- 35    In order for a hand prosthesis that is intended to replace a lost human hand and that comprises on the one hand a wrist part and on the other hand an arm part, to be able to control an arrangement between the wrist part and arm part, the arrangement having means for mutual tilting and turning between the wrist and arm part, the hand prosthesis receives a

substantially natural movement pattern. Furthermore, by providing the arrangement with two substantially orthogonal axes the joint is enabled by means of two motors coupled to an arm cavity to execute on the one hand a tilting movement and on the other hand a turning movement, which  
5 movements may be executed together or individually.

### DESCRIPTION OF THE DRAWINGS

10 The invention will be described in more detail by means of an example of implementation and with reference to the accompanying drawings.

Fig. 1 is a diagrammatic perspective view of an arrangement according to the invention for a hand prosthesis with the hand part in an outstretched position.  
15

Fig. 2 is a diagrammatic view according to Fig. 1, pivoted by 90° and showing the palm of the hand.

Fig. 3 is a diagrammatic view according to Fig. 1 seen from the side of the thumb with the hand part in an outstretched position.  
20

Fig. 4a is a diagrammatic view according to Fig. 1 seen from the thumb side with the hand part in an upturned position.

25 Fig. 4b is a diagrammatic view according to Fig. 4a but in the downwardly tilted position.

Fig. 5 is a diagrammatic view from above of an arrangement according to the invention.  
30

Fig. 6 is a diagrammatic perspective view according to Fig. 5 in a position corresponding to that of a tilted hand part.

### 35 DESCRIPTION OF THE EXAMPLE OF IMPLEMENTATION

An arrangement is generally denoted by the reference numeral 1 in the drawings. The arrangement 1 is arranged on a hand prosthesis 2 between a wrist part 2a and an artificial arm or arm part 2b, and comprises means  
40 3 to permit mutual turning and/or tilting between the parts 2a, 2b, wherein the tilting or turning movements can be executed individually or together. These movements allow human hand movements to be

simulated.

5 The word tilting is used hereinafter to distinguish it from turning, and involves pivoting a hand with respect to an arm or arm part in substantially the same way or direction of pivoting as the fingers of the hand are capable of turning or pivoting about their points of securement in the middle hand.

10 The two parts are substantially identical in shape and each comprises a U-shaped member, the U-shaped member having a base and two legs. The external part of the legs has a continuous opening in which is arranged a shaft 6a, 6b. The base of the U-shaped member is adapted to be arranged in the middle hand or pivotably arranged on the arm shaft 3b. The arm part 2b has a somewhat smaller distance between the legs of the U-shaped member so that it can be accommodated between the legs of the wrist part, the shafts 6a, 6b being arranged through a leg of respectively 2a, 2b. The shafts 6a, 6b are in this connection adapted to allow tilting of the wrist part 2a. On each one end of the two shafts 6a, 6b there is arranged outside the U-shaped member a transmission means 5 which connects the shaft 6a, 6b to motors 4a, 4b respectively, which latter are joined to the wrist part 2a. The motors 4a, 4b are preferably electrically driven and can be connected to a power source, for example a battery (not shown). On the two second ends of the shafts 6a, 6b, both of which are thus arranged between all four legs, there is a V-gear 7a, 7b, which V-gear 7a, 7b is joined to an arm cavity 8 that also includes V-teeth. Accordingly, when the V-gears 7a, 7b secured to the shafts 6a, 6b rotate in different directions around their common shafts this causes the said shafts 6a, 6b to rotate in the same direction around the arm cavity 8. This produces a turning of the wrist part relative to the arm cavity 8, for example in a position according to Fig. 1 and to a position 2, or vice versa. This turning movement can thus be effected by both motors 4a, 4b together. The magnitude of the turning movement is preferably ca. 150-180°.

35 In an alternative embodiment the transmission means 5 comprise toothed belts.

40 When the motors deliver power to drive the two shafts in the same direction of rotation with reference to their common longitudinal shafts, this means that the rotation of the shafts 6a, 6b relative to the arm part 2b is locked by the arm cavity 8 and the wrist part 2a can pivot relative to the shafts 6a, 6b, whereupon the wrist part 2a tilts and thereby tilts the

whole hand prosthesis 2. Accordingly, the power supplied by both motors 4a, 4b can be used jointly to execute a tilting movement, as shown in Figs. 3 and 4. The tilting movement may take place both upwardly and downwardly, as shown in Figs. 4a and 4b, from an outstretched hand position, Fig. 3. The whole tilting movement preferably covers an angle of ca. 150° - 180°.

The motors 4a, 4b may also be driven so that they execute both turning and tilting movements in combination, i.e. so that the wrist is tilted and turned simultaneously. This means that, seen from the lower arm 3, the prosthesis hand should be able to execute not only an upward/downward tilting movement or pivoting in both directions around the arm shaft 3b, but should also be able to move obliquely upwards to the right, obliquely upwards to the left, obliquely downwards to the right and obliquely downwards to the left.

In order that the power delivered by the two motors is utilised simultaneously so as to effect tilting or turning, a maximum energy output can be ensured for the motors 4a, 4b and accordingly the space occupied by the motors can be effectively utilised.

In an alternative embodiment of the arrangement, the arm part and wrist part may for example change places, the wrist part then being the part that is accommodated within the arm shaft 3b.

The invention is not intended to be limited to the aforescribed example, but can be varied within the scope of the claims.

**SUMMARY LIST OF REFERENCE NUMERALS**

	1	arrangement
	2	hand prosthesis
5	2a	wrist part
	2b	arm part
	3	lower arm
	4	drive means
	4a, 4b	electric motors
10	5	transmission means
	6a, 6b	coaxial shafts
	7a, 7b	gear wheel
	8	arm cavity

## Claims

1. Arrangement (1) for a hand prosthesis (2), which hand prosthesis (2) is adapted to replace a lost human hand on a human or artificial lower arm (3) and comprises on the one hand a wrist part (2a) and on the other hand an arm part (2b), the said arrangement (1) being  
5 situated between the wrist part (2a) and the lower arm (3), characterised in that the arrangement (1) has means to permit tilting and turning of the wrist part (2) relative to the lower arm (3).
2. Arrangement according to claim 1, characterised in that the means  
10 comprise two substantially orthogonal shafts (6a, 6b and 3b), around which the parts (2a, 2b) are capable of tilting or turning.
3. Arrangement according to claim 1 or 2, characterised in that the  
15 means permit simultaneous tilting and turning movements.
4. Arrangement according to any of the preceding claims, characterised  
in that the means comprise a drive unit.
5. Arrangement according to claim 4, characterised in that the drive  
20 unit comprises two electric motors (4a, 4b).
6. Arrangement according to claims 4 and 5, characterised in that the  
means comprise a transmission (5) adapted to convert the energy of  
25 the drive unit for tilting and/or turning movements of the hand prosthesis (2) relative to the arm part (2b).
7. Arrangement according to claims 4 to 6, characterised in that the  
motors (4a, 4b) are capable of executing jointly at least some of the  
turning and tilting movements.  
30
8. Arrangement according to claims 4 to 7, characterised in that the  
drive device is connected to the wrist part (2a) and is adapted to  
drive via a transmission means (5a, 5b) two coaxial shafts (6a, 6b)  
35 accommodated on the wrist part (2a), which shafts are in turn capable of actuating, via outer gears (7a, 7b), an arm cavity (8) connected to the arm shaft (3b), around which the arm part (2b) is able to turn, and that the wrist part (2a) is capable of tilting around the two coaxial shafts (6a, 6b).

9. Method of effecting a movement between a wrist part (2a) and an arm part (2b), characterised in that

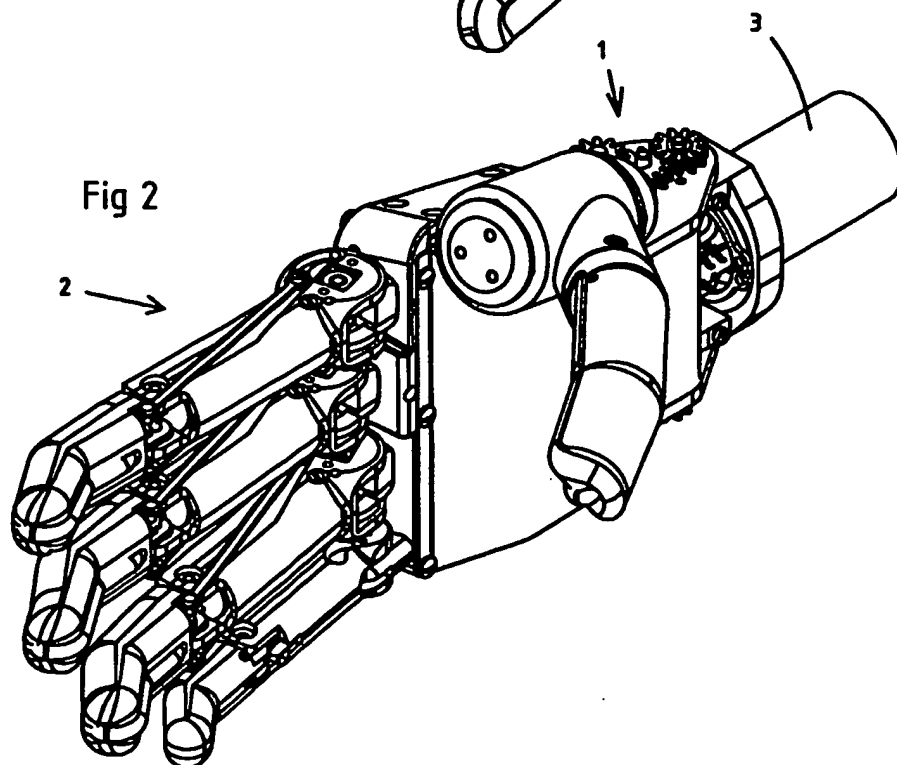
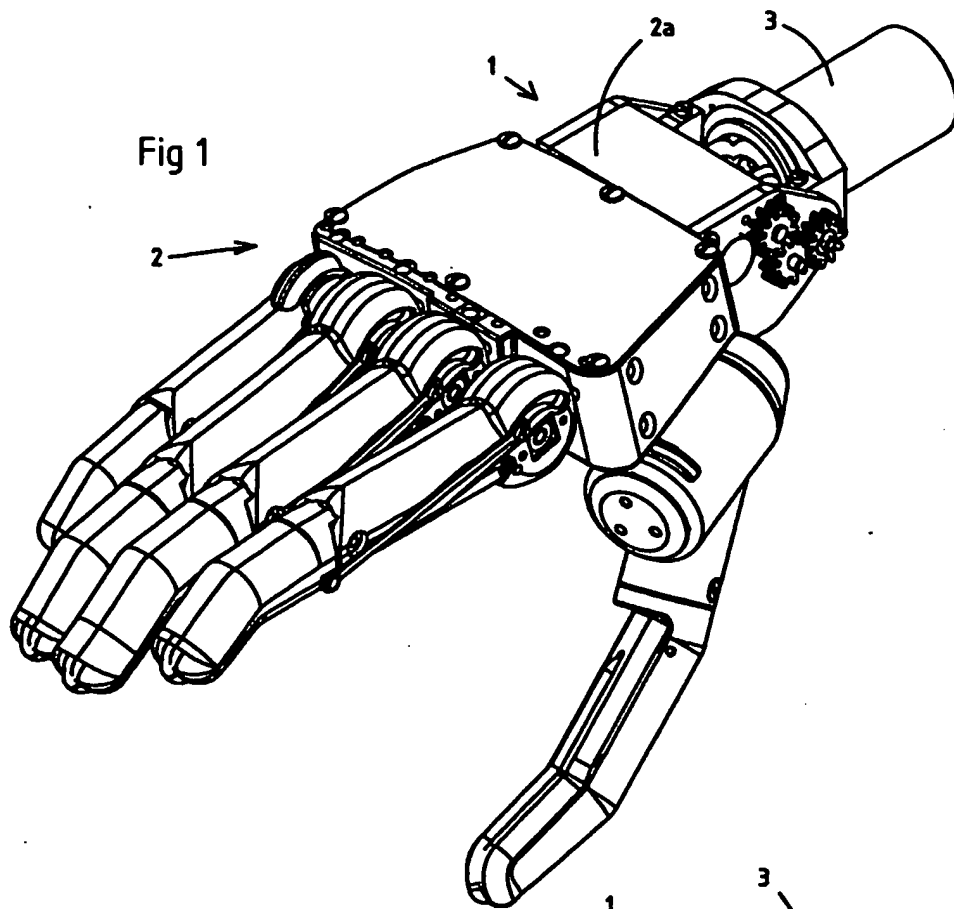
- two controllable motors (4a, 4b) are arranged on the wrist part (2a) and are adapted to drive two coaxial shafts (6a, 6b) aligned therewith,

- a gear (7a, 7b) is arranged on each shaft (6a, 6b) in a gear-type engagement with an arm cavity (8) connected to an arm shaft (3b),

- the arm shaft (3b) is mounted in the arm part (2b), and

- the motors (4a, 4b) are controlled so that the gears (7a, 7b) can rotate relative to the wrist part (2a) in the same direction in order to tilt the wrist part (2a) and/or so that the gears (7a, 7b) can rotate relative to the wrist part (2a) in different directions so as to turn the wrist part (2a) relative to the arm part (2b).





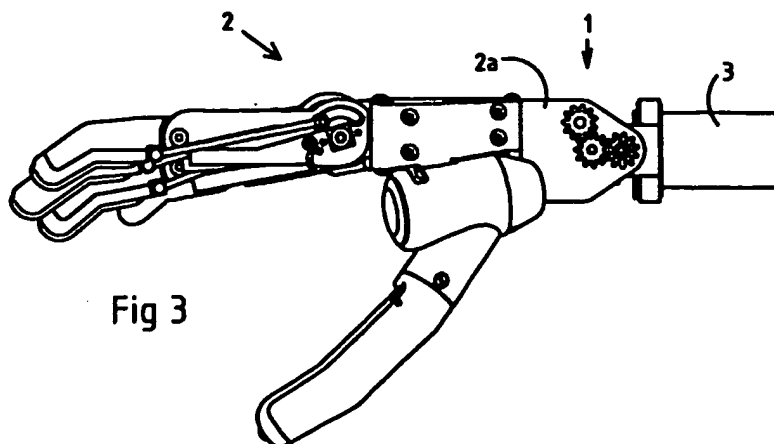


Fig 3

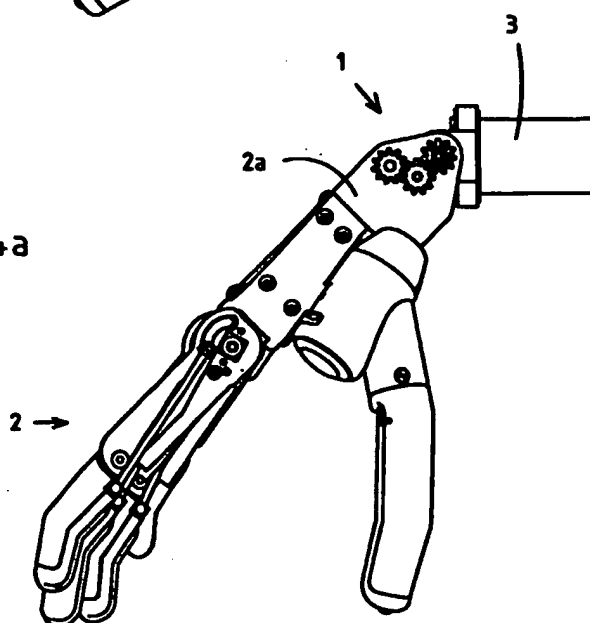


Fig 4a

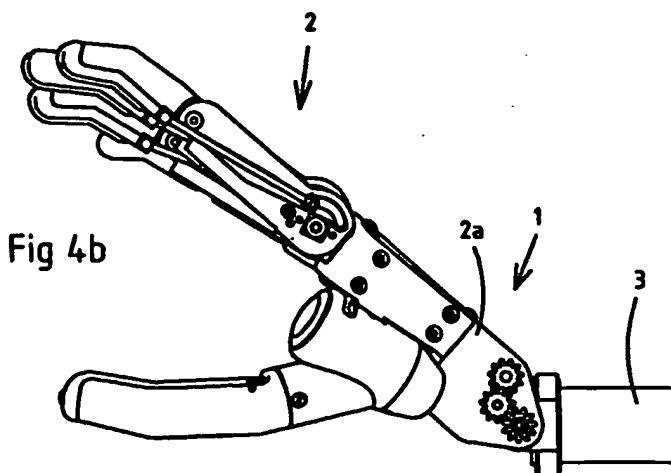


Fig 4b

Fig 5

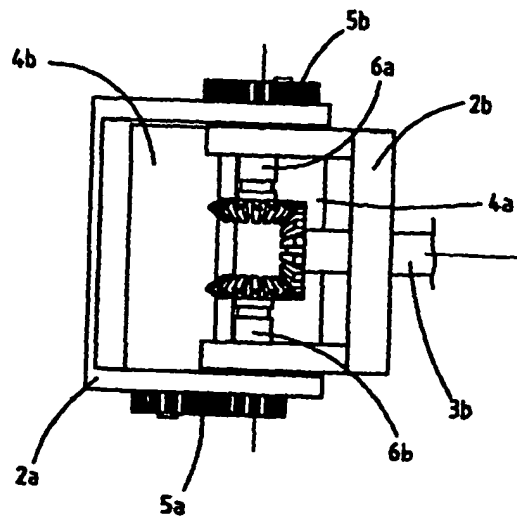
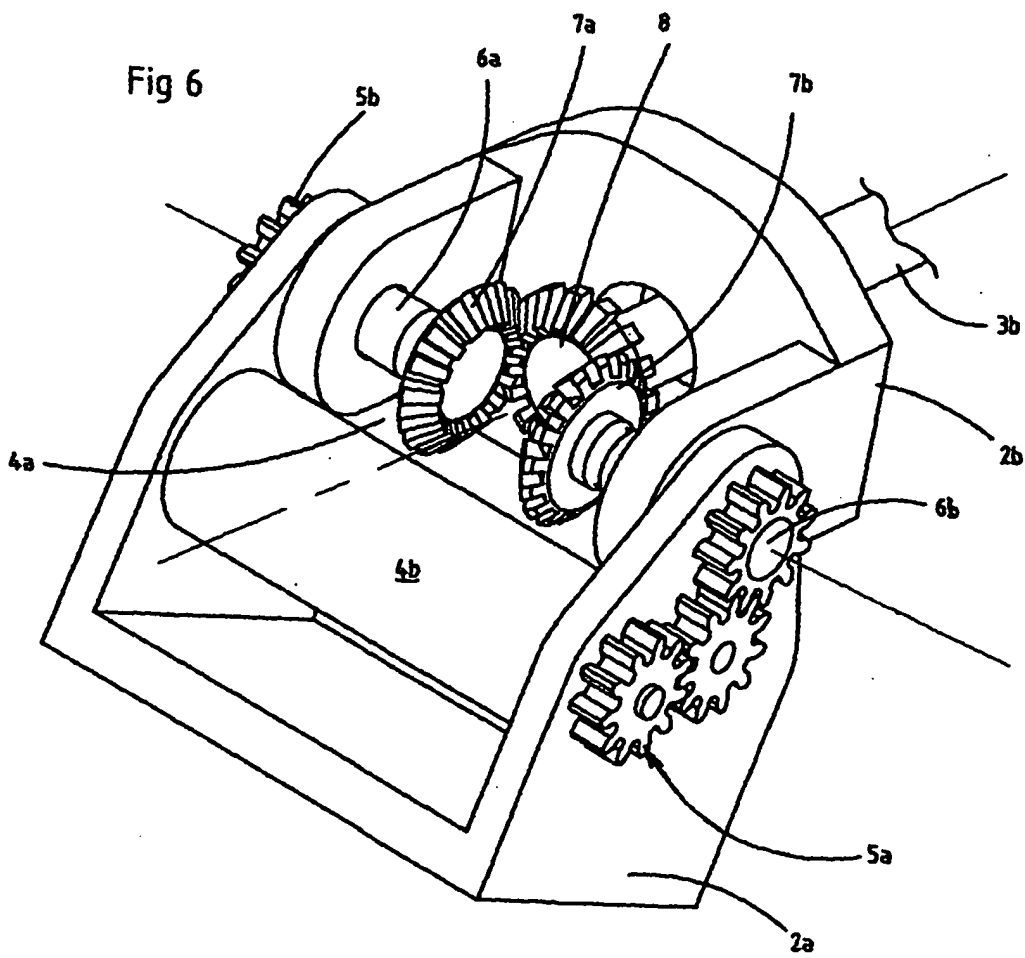


Fig 6



## INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/01505

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: A61F 2/58

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: A61F, F16H, B25J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI DATA

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2535489 A (H.T. EDWARDS), 26 December 1950 (26.12.50), column 4, line 35 - line 49, figures 1, 5	1,4-6
Y		2-3
A	--	5,7-9
Y	US 4353677 A (K.J. SUSNJARA ET AL), 12 October 1982 (12.10.82), column 3, line 54 - column 4, line 2, figure 2	2-3
A	--	1

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

\* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/SE 02/01505

## C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 4685929 A (J. MONESTIER), 11 August 1987 (11.08.87), column 2, line 4 - line 56, figure 2  --	1-4,6,9
A	US 1385817 A (O. LE G. DILWORTH), 26 July 1921 (26.07.21), the whole document  -- -----	1-4,6,9

**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

28/10/02

International application No.  
PCT/SE 02/01505

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US	4353677	A	12/10/82	NONE		
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